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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : H. MURAKAMI et al.
Serial No. : 10/517,502
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For : STEEL SHEET FOR VITREOUS ENAMELING AND
PRODUCTION METHOD

Commissioner for Patents
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DECLARATION UNDER 37 C.F.R. § 1.132

SIR:

I, Hidekuni MURAKAMI, declare as follows:

I. (a). I am a co-inventor of the above-identified patent application.

(b). In March, 1986, I graduated from Kyushu University, Japan in the
Master Course Science and Engineering.

(c). Since April, 1986, I have been employed by Nippon Steel Cooperation,
Tokyo, Japan, at the Technical Development Bureau, Yawata Research Laboratory, in the
field of research with respect to steel sheet.

(d). Nippon Steel Corporation, Tokyo, Japan is the assignee of the above-
identified patent application.

(e). I have read and understood the specification and claims of the above-
identified patent application. I have read and understood the Office Actions in the above-
identified patent application. I have read and understood cited prior art reference Japan No.

2002-80934 ("JP '934"), which has been cited to reject the claims of the above-identified patent application.

II. The invention of the above-identified patent application, as defined in independent claims 1, 2 and 3, is directed to a steel sheet for vitreous enameling wherein the steel sheet contains simple or compound nitrides containing B or Al (precipitates) wherein the nitride size distribution is defined as the follows:

- (1). diameter of 0.02 to 0.50 μm ;
- (2). average diameter of 0.080 μm or larger; and
- (3). the proportion of the number of nitrides having a diameter of 0.050 μm or smaller to the total number of the nitrides is 10% or less.

III. (a). The distribution of the sizes of the nitrides of independent claims 1, 2 and 3 is disclosed in the specification at page 8, line 33 to page 9, line 4 and page 11, lines 21 to 26.

(b). The distribution of the sizes of the nitrides in the present invention is an important factor for improving aging resistance and resistance to bubbles and black spots. Specification, page 8, lines 31 to 33. The present invention is directed to providing large nitrides (average diameter 0.080 μm or larger; proportion of the number of nitrides of 0.050 μm diameter or smaller to the total number of nitrides being 10% or less) because it is believed that at high temperatures, such as annealing or vitreous enameling baking, fine nitrides are likely to decompose and therefore deteriorate aging and resistance to bubbles and black spots. Specification, page 9, lines 4 to 10.

IV. (a). The present invention provides a production process to optimize the distribution of the size of the nitrides by controlling the temperature history prior to hot rolling and the reduction ratio during hot rolling. Specification, page 11, lines 18 to 20.

(b). The present invention controls the temperature history prior to hot rolling as follows. See specification, page 10, line 29 to page 11, line 7.

(1). Retain the slab in a temperature range of from 900°C to 1100°C (Retained Temperature Range 1) for 300 minutes or longer;
(2). thereafter, retain the slab in a temperature range of not less than 50°C higher than Retained Temperature Range 1 (Retained Temperature Range 2) for 10 to 30 minutes;

(3). then, cooling the slab at a cooling rate of 2°C/sec. or less to not less than 50°C lower than Retained Temperature Range 2 (Retained Temperature Range 3) and retaining the slab in Retained Temperature Range 3 for 3 to 10 minutes;

(4). thereafter, commence hot rolling.

(c). During hot rolling, the present invention controls the reduction ratio as follows. Specification, page 11, lines 27 to 32.

(1). After the hot rolling reduction ratio reaches 50% or more, stop the hot rolling and retain the hot rolled material in a temperature range from 900°C to 1,200°C for 2 minutes or longer with the temperature of the hot rolled material not lowered to 900°C or less;

(2). thereafter, commence the hot rolling again.

V. The nitride size distribution in JP '934 is disclosed in paragraph [0003] and claim 3 of JP '934 as follows:

(1). diameter of 0.005 to 0.50 μm ;
(2). average diameter of 0.010 or more; and
(3). the proportion of the number of nitrides having a diameter of 0.010 μm or smaller to the total number of nitrides is 10% or less.

VI. The production process of JP '934 is disclosed in paragraphs [0010] to [0016] as follows:

- (1). heating the slab to a temperature of 1,000 to 1,150°C;
- (2). hot rolling the slab to provide a hot rolled sheet;
- (3). coiling the hot rolled sheet at a temperature of 650 to 750°C;
- (4). cold rolling the hot rolled sheet at a reduction rate of 60% or more;
- (5). annealing the cold rolled sheet at a temperature of more than the recrystallization temperature; and
- (6). skin-pass rolling the annealed cold rolled sheet at a reduction rate of 5% or less.

VII. (a). Table 2 in JP '934 at page 7, in the next to last column, has the heading "RA/ μ m". The heading "RA/ μ m" means the average diameter of the measured nitrides in the steel sheet of JP '934.

(b). The maximum average diameter Ra of the nitrides in Table 2 of JP '934 is 0.032 μ m (Example 32).

VIII. (a). An average diameter of nitrides of 0.010 more in JP '934 does not disclose or suggest an average diameter of nitrides of 0.080 μ m or more in accordance with the present invention. This is especially true when Table 2 of the examples of JP '934 discloses a maximum average diameter of the nitrides to be 0.032 μ m (Example 32).

(b). The maximum average diameter of the nitrides of the examples of JP '934 of 0.032 μ m (Example 32) is 60% smaller than the minimum average diameter of the nitrides of 0.080 μ m required by the present invention as claimed in independent claims 1, 2 and 3.

(c). The requirement of JP '934 that the proportion of the number of nitrides having a diameter of 0.010 μm or smaller to the total number of nitrides is 10% or less does not disclose or suggest the requirement of the present invention, as claimed in independent claims 1, 2 and 3, where the proportion of the number of nitrides having a diameter of 0.05 μm or smaller to the total number of nitrides is 10% or less. The 0.050 μm diameter defined in the present invention is 5 times greater than the 0.010 μm diameter of JP '934.

IX. (a). JP '934 does not disclose or suggest the production process of the present invention discussed in IV above. The production process of the present invention has the purpose of optimizing the nitride size distribution of the present invention defined in independent claims 1, 2 and 3 by controlling the temperature history of the slab prior to hot rolling and the reduction ratio during hot rolling. Specification, page 11, lines 18 to 20.

(b). JP '934 does not disclose or suggest a production process to obtain the nitride size distribution of the present invention as defined in independent claims 1, 2 and 3.

X. (a). Fig. 1, attached hereto, is a graph of the diameter (μm) of the nitride precipitates versus the frequency of existence of the nitride precipitates for each diameter of the nitride precipitates for JP '934 and the present invention. The average diameter for the nitride precipitates of JP '934 is taken as a little more than 0.02 μm and the average diameter of the nitride precipitates of the present invention is taken as 0.08 μm .

(b). The data of Fig. 1 was obtained by the SPEED analysis method described at page 9 of the specification of the present application.

(c). The cross-hatched area of Fig. 1 represents the nitride size distribution of JP '934. Area A of Fig. 1 is for nitride precipitates of JP '934 having a

diameter 0.005 to 0.01 μm ; Area B of Fig. 1 is for nitride precipitates of JP '934 having a diameter 0.01 to average diameter μm ; Area C of Fig. 1 is for nitride precipitates of JP '934 having a diameter of average diameter and greater. The data of Areas A and B of Fig. 1 were taken from the Examples of JP '934. The data of Area C of Fig. 1 are a value picked from the claim conditions of JP '934.

(d). The dashed line in Fig. 1 represents the present invention with an average nitride precipitates diameter of 0.08 μm .

(e). Fig. 1 shows that even if only nitride precipitates of JP '934 having a diameter of 0.02 μm or more are counted, JP '934 could not possibly have an average nitride precipitate diameter of 0.080 μm or larger.

XI. (a). In Fig. 2 attached hereto, the diamond shaped blue data points represent the present invention and the square shaped red data points represent JP '934.

(b). Fig. 2 is a graph of tensile strength (MPa) versus total elongation (%).

(c). Fig. 2, attached hereto, illustrates that for a given tensile strength (MPa) the steel sheet of the present invention provides a greater total elongation (%) than the steel sheet of JP '934.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,

Hidekuni Murakami
Hidekuni MURAKAMI

July 3, 2008
[Date]

FIG. 1

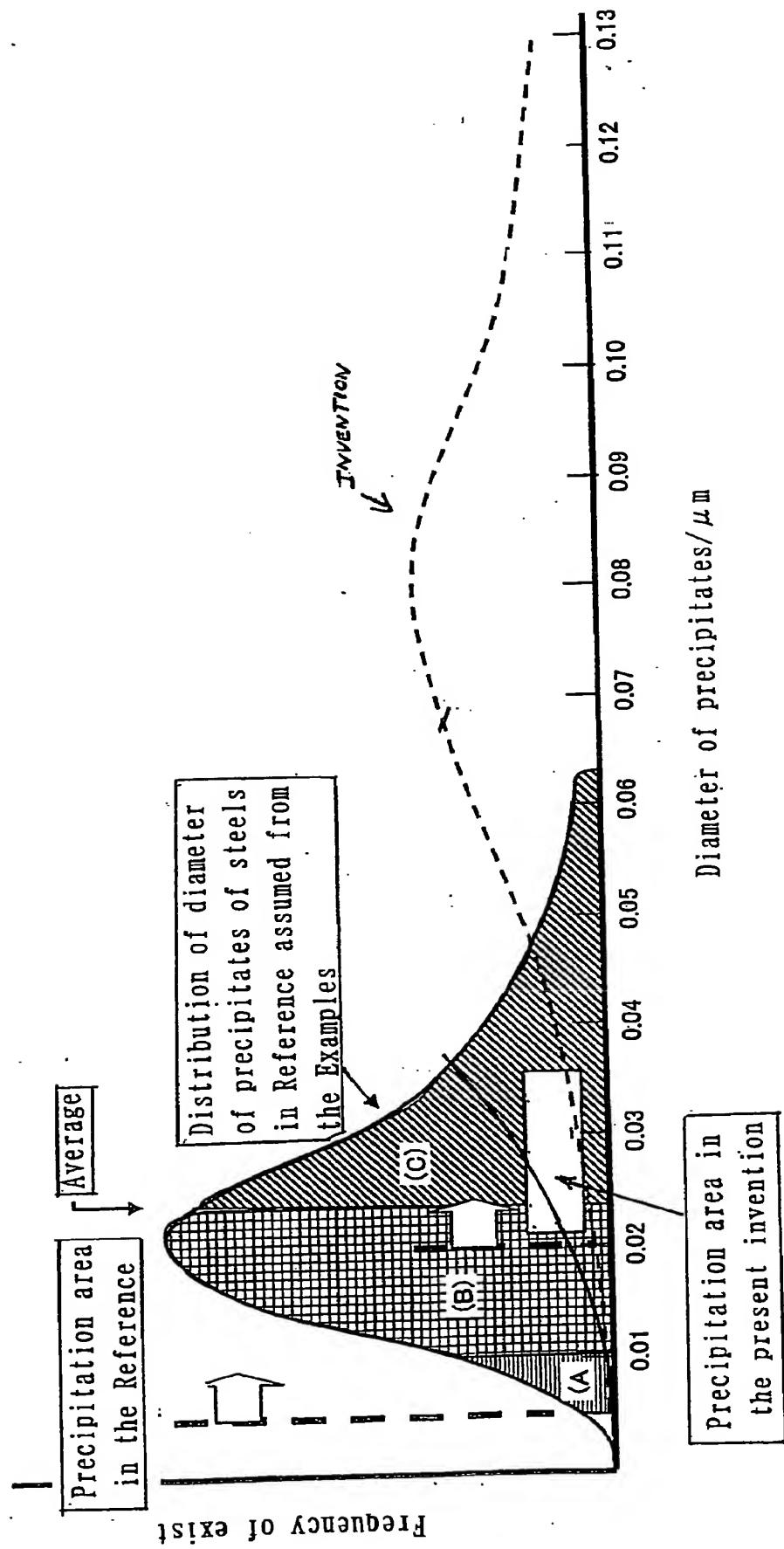


Fig. 2

